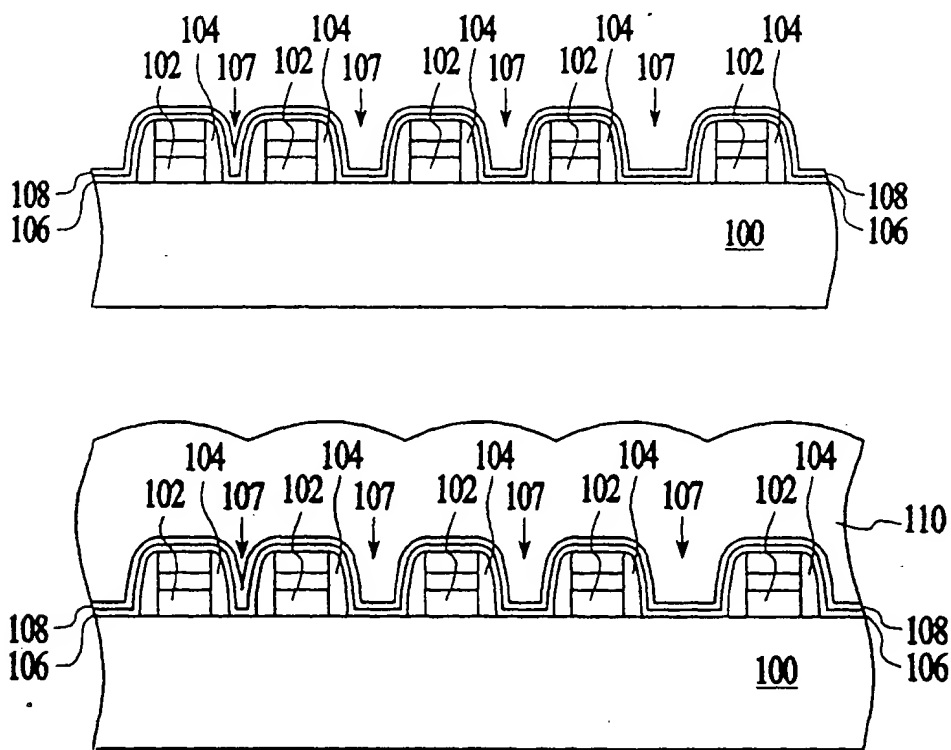


Remarks/Arguments

Claims 1-2, 4-6, and 10-32 are pending. No claims are amended. New claims 24-32 have now been added.

The instant patent application relates to a process for filling recesses on the surface of a workpiece with dielectric material. In accordance with one embodiment shown in Figures 4B-C (reproduced below), a first oxide layer (108) is deposited under high ozone:TEOS conditions, followed by a second oxide layer (110) deposited with a lower ozone:TEOS ratio.



As shown above and previously emphasized in responding to the last office action, both oxide layer 108 and oxide layer 110 are deposited within the recess or gap. Deposition of material 110 within the recess is described in independent claims 1, 13, and 20.

In the previous office action mailed June 4, 2003, the Examiner rejected certain of the pending claims as anticipated under 35 U.S.C. 102 by U.S. patent no. 6,489,254 to Kelkar et al. ("the Kelkar patent"). These claim rejections were duly traversed based upon the failure of the Kelkar patent to show deposition of a second oxide layer within a recess.

Now, in the instant office action, the Examiner has rejected all of the pending claims as obvious in light of the Kelkar patent. These claim rejections are again overcome, as described in detail below.

As a threshold matter, the Examiner is reminded that in order to establish a prima facie case of obviousness, "the prior art reference (or references when combined) must teach or suggest all the claim limitations." MPEP 2142. Here, the Kelkar patent fails even to suggest, a process wherein a second oxide layer is deposited within a recess.

The Kelkar patent describes methods for forming dielectric material over a workpiece. The Kelkar patent notes that conventional approaches to gap-filling have employed borophosphosilicate (BPSG) material exhibiting favorable gettering properties:

The purpose for using the BPSG film as the interlayer dielectric film is based on a gettering property and on a reflow property. It is important that the dielectric film have good gettering properties as it is desired to be able to getter effectively to remove any impurities that are introduced during the wafer fabrication process. (Emphasis added; col. 1, lines 42-47)

As initially deposited, however, the Kelkar patent specifically notes BPSG's lack of suitability for gap-filling:

the heavily doped BPSG film does not have good as-deposited gapfill qualities. (Emphasis added; col. 1, lines 66-67)

Accordingly, the Kelkar patent describes the conventional step of performing a reflow of the BPSG at high temperatures to ensure gap-fill (col. 1, lines 62-66). The Kelkar patent notes, however, that high temperatures of such a BPSG reflow step in a conventional gap-fill process, may undesirably promote dopant diffusion (col. 2, lines 4-11), concluding that as-deposited, prior art films "tend to provide either good gapfill or good gettering, but not both" (Col. 3, lines 3-4).

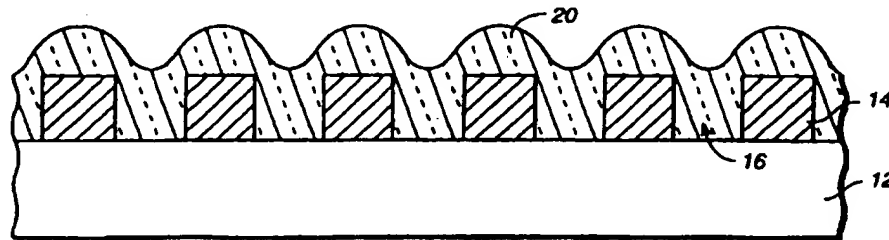
The Kelkar patent then proposes a novel gap-filling process where oxide is deposited in multiple stages:

[t]he method involves first depositing a layer of high-ozone undoped silicon dioxide film that provides the void-free gapfill characteristic and then depositing a low-ozone doped BPSG film that provides the gettering capability. This two layer insulating film provides the ability to have the gaps adequately filled between small or narrow lines without sacrificing good mobile-ion gettering properties. (Emphasis added; col. 2, line 65 - col. 3, line 4)

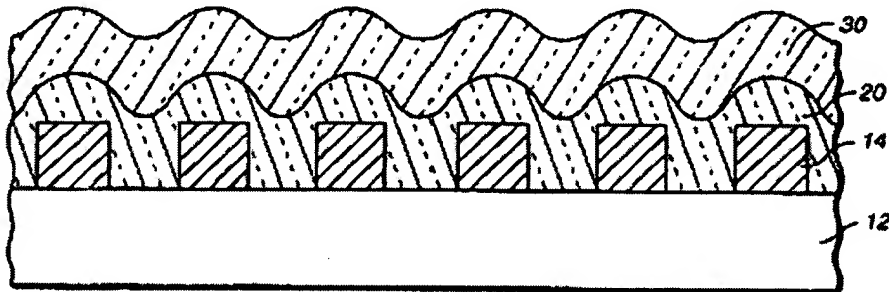
This passage echoes a consistent theme of the Kelkar patent, wherein separate steps of a deposition process result in favorable gap-fill and gettering properties.

Consistent with this theme, Figure 2 of the Kelkar patent (reproduced below) depicts a multistage deposition process wherein a first deposited layer exhibits favorable gap-fill properties and completely occupies the recess:

a layer of high ozone undoped silicon dioxide film 20 is deposited on top of the semiconductor substrate 12 and the polysilicon conductors 14. The high ozone undoped silicon dioxide film covers the polysilicon conductors 14 and fills the gaps 16 between the polysilicon conductors 14. (Emphasis added; col. 3, lines 57-62)



Also consistent with this theme, Figure 3 of the Kelkar patent (reproduced below), shows subsequent deposition of BPSG film (30) without requiring subsequent reflow at high temperatures:



BPSG film 30 provides the mobile ion gettering function that is required by the semiconductor device. (Emphasis added; col. 4, lines 33-34)

The multi-stage process of the Kelkar patent thus represents a hybrid, with gap-fill provided by the first, high O_3 :TEOS stage (FIG. 2), and mobile ion gettering provided by the second, lower O_3 :TEOS stage (FIG. 3). Contrary to the Examiner's assertion, however, the Kelkar patent contains absolutely no teaching, or even suggestion, to employ the first and second oxide layers to perform other than the designated gap-fill and gettering functions, respectively.

In particular, the Kelkar patent fails utterly to teach or even suggest that the second deposited oxide layer could be utilized to complete filling of a recess. Indeed, the Kelkar patent explicitly teaches away from any such suggestion, by emphasizing the unsuitability of as-

deposited BPSG for gap-filling. (See above quotation of col. 1, lines 66-67). This teaching away is consistent with the Kelkar patent's oft-expressed theme of decoupling gap-fill and gettering functions, allocating them to separate process steps.

In light of the absence of any teaching or suggestion by the Kelkar patent to deposit a second oxide layer within the recess, it is respectfully asserted that the currently pending claims cannot be considered obvious in light of that reference. Continued rejection of the pending claims is therefore improper, and these rejections should be withdrawn.

Finally, new claims 24-32 have now been added to the instant application. Support for these claims may be found throughout the specification as originally filed, and at least at ¶[0021]. No new matter has been added to the instant application by these claims.

In view of the foregoing, Applicants believe all claims now pending in this Application are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested. If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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